removal of an untrustworthy system of defence, materially added to our national safety against the importation of infection.

The second question which suggests itself is:—What are the cholera prospects for Europe and this country during 1885? This question is one which it is by no means easy to answer, for to a great extent it must necessarily depend on the action that may have been and still will be taken for the removal of the conditions which are favourable to the diffusion of cholera. From the middle of 1865 to the beginning of 1869 there was probably no time when Europe could be regarded as free from the disease, and it was doubtless only a recrudescence of the same disease that led to the five years' outbreak which, commencing during the summer of 1869, was destined to prevail in one or other part of Europe up to 1874. Or to take individual countries and towns. According to the report of the late Mr. Netten Radcliffe, all the Italian provinces which suffered from cholera in 1865, with three exceptions, were again affected in 1866; the epidemic culminated in 1867, and only came to an end in January 1868. Again, the disease was more extensively diffused through France in 1866 than even in 1865; in 1867 it continued in departments previously infected, and it reappeared in some where it had ceased. In the province of Naples, cholera, commencing in 1865, did not cease until 1867. But fortunately such maintained and recurring prevalences are not the invariable rule, and even the last Neapolitan epidemic of 1873 was of much shorter duration than the earlier ones had been. The common theory that a cholera outbreak in one year is almost certain to be followed by a second one the next year is not a law of epidemics; the fact is rather due either to the failure to remove infected matter left over from the first epidemic, or, as in the case of England in 1865-66, to fresh importation of infection. In brief, it is the sanitary state of Naples, Spezia, parts of Toulon and Marseilles, and such like places, that mainly affords grounds for the fear that no intervention of winter weather can, apart from the adoption of sanitary measures on a wide scale, free the infected places from a contagium which, if left behind, may renew its activity next season. On the other hand, the maintenance of conditions of wholesome cleanliness should give a guarantee that even a fresh importation may fail to spread. Numerous importations took place into this country in 1873, and all proved abortive. Our sanitary authorities can insure a like success in 1885, even if the disease be either maintained or reappear next year in Southern Europe.

DYNAMO-ELECTRIC MACHINERY

Dynamo-Electric Machinery. By Prof. Silvanus P. Thompson. (London: E. and F. N. Spon, 1884.)

PROF. SILVANUS P. THOMPSON has undertaken the task of filling up a most important want in our scientific and technical literature; and he is to be congratulated and warmly thanked for the manner in which the task has been performed. Of the want of a scientific and practical work on dynamo-electric machinery there can be no question. The subject is at present exciting more general attention than was, perhaps, ever before given to any invention, not even excluding the steam-engine or the electric telegraph. The electric light effects are fascinating to a degree; and in these days of exhibitions and displays the natural interest in one of the most beautiful inventions has been fostered even beyond that which is natural: while speculation and even the promises of "electric light in our homes" have led to excitement which has been equally disastrous to the hopes of the many and to the progress of electric lighting itself. We are now entering it is to be hoped, or indeed have already entered, upon a more satisfactory state of things, in which hard and steady work and careful scientific investigation of every point on which efficiency and advantage in electric lighting depends will quietly bring forth an appropriate reward; and will gradually sweep away the painful impressions left by the failures of would-be electricians and of bubble companies.

Information on the subject of dynamo-electric machinery up to the present time has been very much diffused and not convenient for access, and there was great need of a careful hand to bring together as much of it as was really valuable. It consisted chiefly of a multitude of articles in the two English and two or three foreign electrical journals, and a few papers to the learned societies, generally on some special class of machine. Of English books we have scarcely any of importance except those of Mr. James Dredge and of Mr. J. E. H. Gordon, useful in their way as very handsome picture-books, and the former affording admirable detailed and figured diagrams, and a complete list of the legion of recent electric patents. A book of moderate dimensions, and written from a scientific point of view, will be welcomed alike by practical men and by theoretical students of this subject.

In Prof. Thompson's "Dynamo-Electric Machinery" we find, in five preliminary chapters, a satisfactory description of the properties of the magnetic field and of the effect of moving a coil within it; of ideal simple dynamos of different forms, accompanied by curves showing the electromotive forces produced by the rotation of rudimentary coils, the effect of superposition of electromotive forces, and the effect of the commutator. The series dynamo, shunt dynamo, and the compound-wound dynamo are likewise described in simplified form in these preliminary chapters, and likewise the various effects of electro-magnetic induction; and from these preliminary remarks there follows a long list of practical conclusions.

Chapter VI. is devoted to the government of dynamos, a subject which has engrossed a large share of the attention of practical inventors during the last four or five years. So long as electric lighting was carried on with arc lamps alone, and when the arc lamps were so imperfect as they were at that period, irregularities in the action of the dynamo machine were little noticeable in comparison with the irregularities of the arc itself. The use of the incandescent lamp, however, soon made these irregularities only too apparent; and attempts to rectify this defect in the dynamo have given rise to improvements of a very substantial character, not only as to regularity but in economy, and also in other and less important matters.

Following these preliminary chapters we find a very full and very interesting description of all the really important existing dynamos, with an account of their peculiarities and of the purposes for which each is specially

adapted. Prof. Thompson has chosen to classify dynamos according to the nature of the field of force and the manner in which the armature moves in the field of force. It is doubtless difficult to find any very satisfactory mode of classification of these machines: but the reason for the particular classification adopted here is certainly not apparent in the descriptive chapters, in which the nature and effect of the field in the various machines is perhaps the point on which a great deal more information would be desirable. The diagrams and figures in these chapters are all that could be wished for. They are admirably chosen and are well executed.

The mathematical theory of the dynamo machine has of late received considerable accessions; though much yet remains to be done in working out a satisfactory theory by mathematics and experiment combined. The fundamental principles are well known. The experiments of Faraday and Joule, and the mathematical investigations of Helmholtz, Sir William Thomson, and Clerk-Maxwell have formed a good foundation; and considerable advances have recently been made by the labours of Joubert, Mascart, Hopkinson, and Marcel Deprez. The invention by Hopkinson of the "characteristic curve" is a most important step; and the study of these curves is at the present time doing for the dynamo machine the same thing that the study of Watt's indicator diagram does for the steam-engine.

Prof. Thompson devotes a considerable number of chapters to the mathematical theory of the dynamo, and his treatment of the subject is on the whole satisfactory. There are, however, a few points on which in our opinion it requires revision. One of these is the notation; and it would be a great satisfaction if mathematicians and electricians could by some means—for instance, by appointing a committee for the purpose—agree upon some standard notation which would be convenient, and which would harmonise with notations commonly employed in dynamics and in general physics. In several points we could wish to see Prof. Thompson's notation different. It seems, to say the least, a very great pity to use the letter H in mathematical writing connected with magnetism for any purpose besides Earth's Horizontal Force, while the use of the letter i for strength of the current is only a perpetuation of French want of logic.

Prof. Thompson's formulas on the subject of efficiency of a motor are not satisfactory; and it is most unfortunate that he has allowed himself to be misled by his friend, Mr. W. M. Moorsom, into fancying an error in the fundamental equation of Joubert for an alternate-current dynamo. The investigation of Appendix IV. and the physical assumption that the coefficient of self-induction for the armature and the coefficient of mutual induction for the armature and electromagnets are approximately equal in *all* dynamos will not bear examination. It is more than doubtful whether there is *any* dynamo in which this is approximately true. Certainly it would not be true for the Siemens alternate-current machine, with which M. Joubert concerned himself. M. Joubert did not leave the matter as a question of supposition; but showed *by experiment* that the term which is concerned with mutual induction is unimportant, and that on this account the differential equation in question becomes manageable.

One other blemish we cannot pass over. It is the introduction of two or three new words which have been adopted without due weighing of the consequences. That mathematicians have been too slow to form words for new ideas we quite admit; and of the advantage of good words to express clear ideas there can be no question. Witness the comfort of having such words as "radian" for the unit angle, of "volt," "ampere," "watt." But word-making may be carried too far unless caution and judgment be used; and that words so grotesque as "torque" and as "gausses" should be adopted into the English language would be, to say the least, a very great misfortune.

The faults which we have found are, however, few, and not of vital importance, and in conclusion we must once more express our gratitude to Prof. Thompson for a very valuable work. We feel confident that it will find a very wide circle of usefulness and of appreciation.

OUR BOOK SHELF

An Elementary Treatise on Conic Sections and Algebraic Geometry, with Numerous Examples and Hints for their Solution, especially designed for the Use of Beginners. By G. Hale Puckle, M.A. (London: Macmillan & Co., 1884.)

WE are not often called upon to notice the *fifth* edition of a school text-book, but now that we have examined this one and compared it with our familiar third edition copy (issued in 1868) we are glad to be able to say that, though new editions have not appeared with the sensational rapidity of some similar works of late, yet with the steady advance in public favour there has been an evident desire on Mr. Puckle's part to bring up his work to the level of other treatises on the subject. Contrasting the two editions, we find there has been an increase from 343 to 379 pages, and not only has there been careful revision, but also an addition of very many articles of interest. It is to be borne in mind that no attempt is made to bring out a work which shall satisfy the requirements of a University man who is "reading high," but the writer's aim has throughout been to write a purely *elementary* treatise on the lines of Dr. Salmon's "Conics." Mr. Puckle rightly acknowledges his great indebtedness to this now classic work, and on the other hand it should be borne in mind that the first edition came out at a time when Salmon was not openly used as a *College* text-book at Cambridge. We are very glad to notice that Mr. Puckle has, in this last edition, adopted the notation of the general equation of the second order, according to Salmon. It is quite time that this notation should be adopted in all our text-books, for it is a needless burden upon the memory to get up the several conic formulæ under different forms. A useful addition has been made to the number of worked-out exercises. A result of the book's having reached a fifth edition is that we have not noted any errata in the text.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

The Cretaceous Flora of North America

IN the abstract of a paper on the above subject by Mr. J. Starkie Gardner in NATURE of September 25 (p. 528), it is stated that "the lowest beds (of the American Cretaceous) are